NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

GB 5009.301-2025

National food safety standard - Determination of osmotic pressure in food

食品安全国家标准 食品中渗透压的测定

Issued on: March 16, 2025 **Implemented on: March 16, 2026**

Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC

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1 Scope

The standard sets out methods for determining the osmotic pressure of food.

It applies to the determination of osmotic pressure in foods for special dietary uses and in beverages for special uses.

2 Method one - Freezing point method: principle

The osmolality of a solution is determined indirectly by measuring the depression of its freezing point. In an ideal dilute solution the freezing point depression is proportional to the molality of the solution through the freezing point depression constant, whose value is 1.86 when water is the solvent, while the osmotic pressure is proportional to the same molality through the osmotic constant. Since the concentration term is the same in both relations, the freezing point depression method can be used to determine the osmolality of the

solution.

3 Method one: reagents and materials

The water used is grade three water as defined in GB/T 6682.

3.1 Reagent: sodium chloride (NaCl), working primary reagent.

3.2 Standard solutions of the primary reagent are prepared as in Annex A; alternatively a nationally certified osmolality standard solution may be used.

4 Method one: apparatus and equipment

4.1 Freezing point osmometer. 4.2 Analytical balances reading to 0.1 mg and to 0.001 g. 4.3 Muffle furnace. 4.4 Desiccator holding a desiccant. 4.5 Ultrasonic cleaner. 4.6 Homogenising paddle blender. 4.7 Pipettor.

5 Method one: analytical procedure

5.1 Sample preparation. For a liquid sample, not less than 100 mL is taken and mixed thoroughly to make the test solution, bubbles being avoided as far as possible during mixing and ultrasonic treatment applied where needed. For a solid sample, not less than 200 g is taken, mixed thoroughly and made up into the test solution at the reconstitution ratio or by the preparation method stated on the label or in the instructions, again avoiding bubbles and applying ultrasonic treatment where needed. For a semi-solid sample, not less than 200 g is taken, poured into a homogenising paddle bag, paddled for 5 min at eight strokes per second, poured into a beaker and left to stand for 15 min for the foam to settle.

5.2 Procedure. The freezing point osmometer is calibrated with the standard sodium chloride solution as required by its calibration procedure, and the osmotic pressure value of the test solution shall fall within the range of the calibrating solutions. A measured quantity of the test solution is then drawn accurately into the sample tube, bubbles being avoided, and the test is run as required by the operating procedure of the instrument, the data being recorded when the measurement is finished. The probe is then wiped clean gently and the instrument left to settle before the next sample is tested. Note 1: vibration and interference are to be kept low during testing. Note 2: where the test sample does not freeze normally, it is not suited to this method.

6 Method one: expression of analytical results

The result is expressed as the arithmetic mean of two independent determinations obtained under repeatability conditions, calculated to a whole number. The result is expressed in milliosmoles per kilogram (mOsmol/kg or mOsmol/kg of water).

7 Method one: precision

The absolute difference between two independent determinations obtained under repeatability conditions shall not exceed 5 % of their arithmetic mean.

8 Method two - Dew point method: principle

The osmolality of a solution is determined indirectly by measuring the depression of its vapour pressure. The vapour pressure depression is proportional to the molality of the sample solution, and that molality can be converted to osmotic pressure through the osmotic constant; the greater the vapour pressure depression, the lower the corresponding dew point temperature.

9 Method two: reagents and materials

The water used is grade three water as defined in GB/T 6682.

9.1 The reagent is the same as in 3.1, sodium chloride working primary reagent.

9.2 Standard solutions of the primary reagent are prepared as in Annex B; alternatively a nationally certified osmolality standard solution may be used.

10 Method two: apparatus and equipment

10.1 Dew point osmometer. 10.2 to 10.4 The balances, muffle furnace and desiccator are the same as in 4.2, 4.3 and 4.4. 10.5 Micropipettor, 2 µL to 20 µL. 10.6 Sample discs matched to the model of instrument.

11 Method two: analytical procedure

11.1 Sample preparation is the same as in 5.1.

11.2 Procedure. The dew point osmometer is calibrated with the standard sodium chloride solution as required by its calibration procedure, and the sample tested shall fall within the range of the calibrating solutions. A measured quantity of the test solution is then dropped accurately onto the sample disc and, once it has been absorbed evenly, the test is run as required by the operating procedure of the instrument and the data recorded when the measurement is finished. The sample cell is then wiped clean and the instrument left to settle before the next sample is tested. Note: the method does not suit foods that decompose easily on heating or that hold ethanol or other volatile solutions.

12 Method two: expression of analytical results

The result is expressed as the arithmetic mean of two independent determinations obtained under repeatability conditions, calculated to a whole number. The result is expressed in

millimoles per kilogram (mmol/kg).

13 Method two: precision

The precision requirement is the same as in Clause 7.

A Annex A Preparation of the standard solution of primary reagent for the freezing point method

A suitable quantity of primary sodium chloride reagent is placed in a crucible and dried in a muffle furnace at 500 °C to 650 °C for 40 min to 50 min. The crucible is taken out and placed in a silica gel desiccator to cool to room temperature. As required, a weighed quantity of the working primary sodium chloride reagent, taken from Table A.1, is dissolved in 1 kg of water and shaken to mix; the solution is kept in a brown glass bottle and may be stored for three months at room temperature.

Table A.1 gives, for the freezing point method, the mass of sodium chloride per kilogram of water in grams, the osmolality in milliosmoles per kilogram and the freezing point depression in degrees Celsius: 3.087, 100, 0.186; 6.260, 200, 0.372; 9.463, 300, 0.558; 12.684, 400, 0.744; 15.916, 500, 0.930; 19.147, 600, 1.116; 22.380, 700, 1.302.

B Annex B Preparation of the standard solution of primary reagent for the dew point method

The preparation is the same as for the freezing point method: a suitable quantity of primary sodium chloride reagent is dried in a crucible in a muffle furnace at 500 °C to 650 °C for 40 min to 50 min, cooled to room temperature in a silica gel desiccator, and a weighed quantity taken from Table B.1 is dissolved in 1 kg of water and shaken to mix; the solution is kept in a brown glass bottle and may be stored for three months at room temperature.

Table B.1 gives, for the dew point method, the mass of sodium chloride per kilogram of water in grams against the concentration in millimoles per kilogram: 3.090 and 100; 9.129 and 290; 12.646 and 400; 15.871 and 500; 19.107 and 600; 25.608 and 800; 32.200 and 1 000. The concentration steps of this table are printed as 100, 290, 400, 500, 600, 800 and 1 000, so the series is irregular where Table A.1 runs in even hundreds; the values are reported here as printed.